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The Economy and Environment Program for Southeast Asia (EEPSEA) was established in May 1993 to support training and research in environmental and resource economics across its 9 member countries: Cambodia, China, Indonesia, Laos, Malaysia, Papua New Guinea, the Philippines, Thailand, and Viet Nam. Its goal is to strengthen local capacity for the economic analysis of environmental problems so that researchers can provide sound advice to policymakers.

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Using Market Mechanisms To Improve Fishery Production – A Case Study From Thailand

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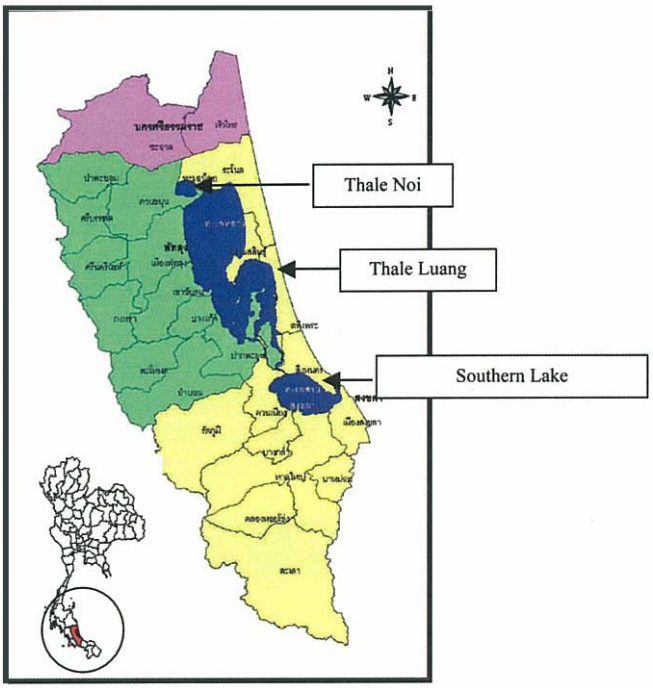
Hundreds of thousands of people rely on the fisheries of Thailand's Songkhla Lake for their livelihoods. Unfortunately, effluent from factories and farms in the region is heavily polluting the lake, which lies on the east coast of the country. Now a new EEPSEA study looks at the pollution in the lake and its impact on fishery production. It also assesses technological and policy options to improve water quality and so boost →

A summary of EEPSEA Research Report No. 2010-RR5: 'Pollution Control and Sustainable Fisheries Management in Songkhla Lake, Thailand' by Kunlayanee Pornpinatepong and her research team members from the Department of Economics, Prince of Songkla University, Hat Yai, Songkhla, Thailand 90112. Tel: (66) 74 282441; Fax: (66) 74 282410 Email: kunlayanee.p@psu.ac.th

" Market-based mechanisms could ...



The physical and administrative areas of Songkhla Lake Part 1 is Thale Noi, Part 2 is Thale Luang, and Part 3 is Thale Sap Songkhla (Southern Lake).

the lake's ecological health and its economic productivity.

The study is the work of a team of researchers led by Kunlayanee Pornpinatepong from the Prince of Songkla University, Hat Yai, Thailand. It finds that two key market-based mechanisms could give polluting firms a real incentive to adopt appropriate clean-up technology and so reduce the amount of pollution they produce. It therefore recommends that a tradable discharge permit (TDP) system should be applied to large firms and farms, while an emission charge system (ECS) would better suit small- and medium-scale firms and farms.

Songkhla Lake in Southern Thailand

Songkhla Lake covers parts of three provinces, Songkhla, Phatthalung and Nakorn-Srithammarat. The lake is classified as a lagoon system and comprises three interconnected areas. It has a water surface area of 1,040 km2 and is home to 450 fish species and 30 shrimp species. Approximately 800,000 people live around the lake. Many of these people earn their livelihoods from the lake's fisheries, which serve as an important nursery ground for many economically important species of fish, crabs and shrimps. In recent years, however, there have been significant declines in most aquatic catches. This has forced an increasing number of fishermen to find new occupations.

The study first assesses the pollution situation in Songkhla Lake and looks at the impact of pollution on the lake's fisheries. Using 12 years of water quality data (1992–2004), the study clearly shows that the amount of nitrogen and phosphate discharged into Songkhla Lake has increased over time. The major sources of this pollution are the factories and pig farms that pollute the U-Tapao River and the Pawong Canal, both of which flow into the lake. Another important source of pollution is the Pak-ro Channel where there are a large number of shrimp ponds.

The Link between Pollution and Productivity

In order to identify the link between fishery production and water quality in Songkhla Lake, data on pollution levels and the lake's natural shrimp catch are analyzed (the shrimp fishery is the most profitable economic activity that is carried out in Songkhla Lake). The statistical analysis indicates that water quality changes in the lake have a significant impact on shrimp production. In particular, it shows that a one-unit increase in the Water Quality Composite Index (WQCI) at U-Tapao would lead to a shrimp productivity increase of 3.4% and a one-unit increase in the WQCI at Pak-ro would lead to a shrimp productivity increase of 10%. As the size of the shrimp harvest is linked to water quality, the value of the shrimp catch can be used as an indicator of changes in water quality.

Intensive over-fishing is also known to be a cause of fishery degradation. However, this study deals only with the pollution problems facing the lake. This focus was chosen following extensive consultations with

boost the lake's ecological health."

stakeholders. These talks indicated that controlling fishing would be a very sensitive issue, and that fishermen would be more likely to reduce their catches after pollution controls are in place. Also, limited information is available on the full impact of fishing in Songkhla Lake. This means that it would be difficult to fully assess the relationship between fishing effort and fishery value. The study recommends that the issue of controlling fishing should be considered in a separate study.

Technological Options to Improve Water Quality

If nothing is done, the water quality of Songkhla Lake is expected to continue to get worse. This is because the human population in the region is increasing. Shrimp farms, pig farms and other polluting industries around the lake are also getting more numerous. There is therefore an urgent need to reduce the pollution entering the lake. The study therefore looks at the pollution clean up options that are available using a cost-effectiveness analysis (CEA). The various options include systems such as covered anaerobic lagoons and Up Flow Anaerobic Sludge Blankets.

The results of the CEA show that the effectiveness of a treatment plant is sensitive to the size of the plant and the influent load. The study finds that, for domestic treatment facilities at the municipal level, the cost of treating polluted water is very high even at full capacity. Large-scale treatment facilities tend to be ineffective due to under-utilization and poor administrative management. Smaller-scale sewage treatment facilities are therefore recommended as the best way for each community to deal with both household waste and the waste from small firms and farms. It is also clear that it is more cost-effective for small-scale polluters to share a common treatment plant. Effective monitoring is also vital for success and it is recommended that the public should be involved in the monitoring process to ensure transparency and effectiveness.

Clean-up Incentives are Vital

The study shows that the technology exists for firms and farms to clean up their effluent, however, it also shows that they have no incentive to do so. Command and control (CAC) policy is the current water pollution management system in Thailand. Under this approach, factories, pig and shrimp farm entrepreneurs and municipalities must comply with effluent standards and laws. The agencies that implement this legislation focus on crucial pollutants such as Biological Oxygen Demand (BOD), Chemical Oxygen Demand (COD) and Total Kjeldahl Nitrogen (TKN). It is clear that the current policy is not effective. Among the reasons it does not work are the fact that it does not encourage industries to improve their production processes and wastewater treatment systems. Monitoring procedures are also somewhat inefficient and the punishments for those who exceed pollution standards are quite small and not strictly enforced.

What is more, investment in wastewater treatment plants always involves a high cost, and therefore most dischargers avoid such investments where possible. This lack of investment leads to a large amount of pollution. For instance, up to 91% of pig farms and 100% of open system shrimp farms in the U-Tapao catchment directly release untreated wastewater into the environment. It is therefore clear that there is a serious need for incentive mechanisms to be put in place in order to encourage dischargers to reduce their effluent.

A Choice of Market-based Incentives

Market-based instruments are widely acknowledged as having many advantages over command and control regulations. Therefore the study carefully compares the

Effectiveness of the three policy options

Criteria	CAC	ECS	TDP
1. Provides incentive mechanisms for pollution reduction	1	2.57	4
2. Interaction and coordination of stakeholders for water quality improvement	1.43	1.43	3.57
3. The outcome effectiveness of the water quality control policy	1.57	2.43	4
4. Appropriate water quality control standards	4	4	4
5. Controlling all sizes of firms	4	4	4
6. Domestic discharge control available	4	4	4
Mean	**2.67**	**3.07**	**3.93**

Source: assessed by researchers and experts
Note: The rating scale was 1 = none, 2 = low, 3 = moderate, 4 = high.
To get the mean rating, <1.49 = none, 1.5 – 2.49 = low, 2.5 – 3.49 = moderate, and >3.50 = high.

current CAC pollution management system with two potential market-based options: an emission charge system (ECS) and a tradable discharge permit (TDP) system.

An emission charge is a fee paid by a polluting factory. Under the ECS approach, this study assesses the charge would be based on the amount of pollution a factory discharges. The funds that would be collected would be used for industrial pollution management. They would be utilized as a circulating fund, to provide assistance or support for the implementation of industrial pollution management measures. They would also be used for environmental quality monitoring. All factories that discharge wastewater to their surroundings would be obliged to pay this emission charge.

A TDP system offers industrial firms the option to avoid meeting stringent effluent standards by purchasing effluent credits or permits from other firms that can reduce their effluent at a lower cost. It can therefore provide greater flexibility for firms to meet their discharge targets.

Which Market-Based System is Best?

Ten criteria were selected to compare the different policies. These were: public acceptability, legal feasibility, implementation complexity, effectiveness, capital costs, operating costs, transaction costs, impacts, equity, and decentralization. It is found that both an ECS and a TDP system would provide companies with incentives to reduce pollution in a cost-effective way. However, each of these approaches have their own particular advantages and disadvantages.

It is clear that an ECS would suit smaller polluters because it involves lower capital costs. However, it is also clear that it would be difficult to define an optimal fee level for an ECS for the Songkhla Lake area. Such a fee would need to provide enough incentive to encourage pollution clean up without being punitive. Getting this balance right would be a challenge.

The assessment shows that the TDP concept would be an effective approach in the Songkhla Lake watershed. This is because there are varieties of industries in the region with different abatement costs. The potential gains from trading effluent credits or permits are therefore likely to be significant. However, there would also be some disadvantages with a TDP. Firstly, implementing a TDP would require various legislative issues to be resolved. Implementing a TDP would also be complex and such a scheme would therefore require a greater initial investment and also have higher transaction costs. A TDP would also have a low public acceptability rating, as people do not currently understand how such a system functions. Therefore, in order to implement a TDP in a community situation, outreach and education work would be required.

Final Recommendations

The study recommends that, due to the high outcome effectiveness of the TDP and its high capital costs, it would best be applied to large firms and farms. As the ECS would better suit small- and medium-scale firms and farms, it is recommended that it should be applied to such businesses and households. Whichever combination of policy options is ultimately selected, further studies will be needed to iron out the details. Moreover, because each policy provides both advantages and disadvantages, the study suggests that policy-makers assess each option against their own specific goals before they decide how to proceed.

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